Coastal, Navigation, and Emergency Response Data Use

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JACKSONVILLE DISTRICT

US Army Corps of Engineers

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Outline

- **Coastal Storm Damage Reduction Projects**
  - Beach-fx
- **Inlets and Navigation Projects**
  - Coastal Modeling System
- **Post-Storm Missions**
  - Damage assessment and recovery

Conclusions

- **Coastal Storm Damage Reduction Projects**
  - Historical storm databases
    - Improved tropical/extra-tropical storm data
  - Beach-fx support tools for data manipulation
- **Inlets and Navigation Projects**
  - Central data repository--IOOS
  - High resolution survey data
- **Post-storm Missions**
  - Annual LIDAR surveys
- **More permanent wave and water level gages**

What and Why

- **Data Uses in Coastal Engineering:**
  - Existing conditions/problems/opportunities
  - Model inputs/boundary conditions
  - Model calibration/verification
  - Monitor project performance
  - Site specific data are required at every project phase

Beaches

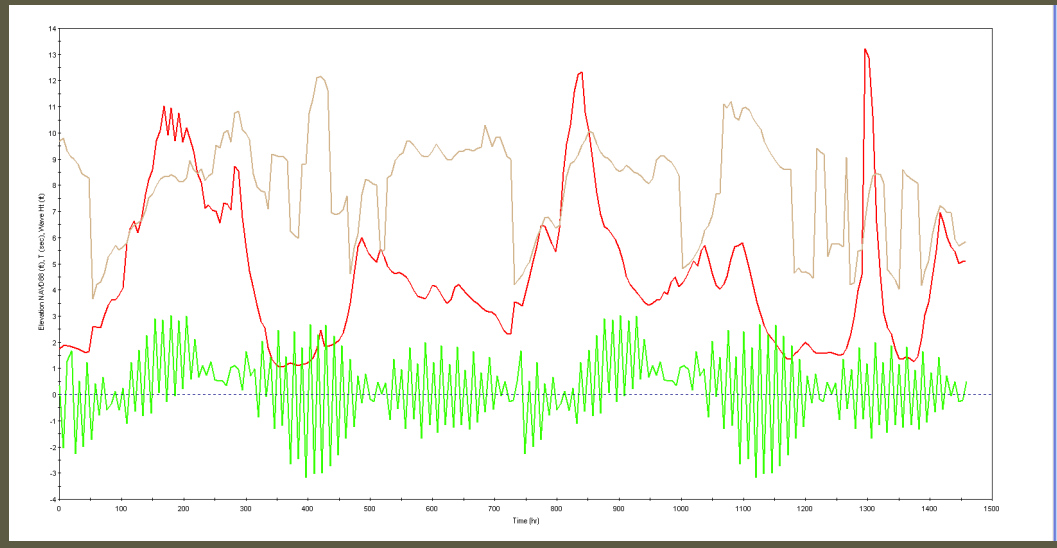
- **Coastal Storm Damage Reduction Studies: Beach-fx is the USACE Required Model**
  - Evaluates the physical performance and economic benefits of shore-protection projects along sandy shores.
  - Economic and engineering inputs required

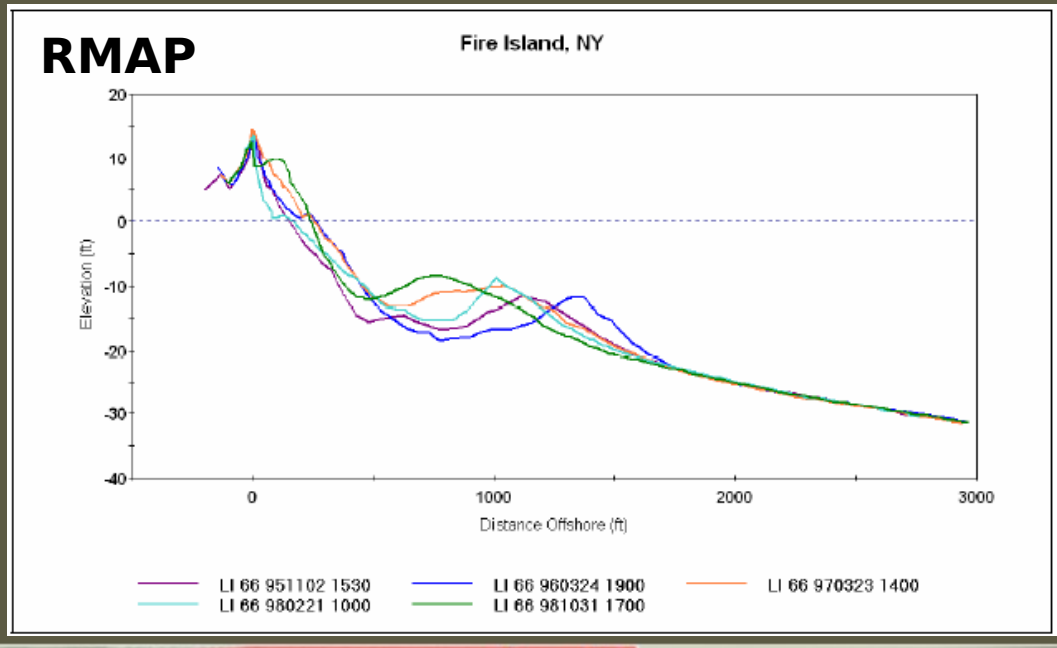
Beach-fx Inputs

- **SBEACH: Storm-inducted BEAch Change model**
  - Shoreline response to storm impacts
  - Wave attack
  - Inundation
- **GENESIS: GENEralized model for Simulating Shoreline Change**
  - Shoreline position throughout project life
  - Erosion rate of planned nourishments
- **Historical storm data**
  - Utilized for Monte Carlo simulations of many project lifetimes
  - Tropical and extra-tropical (nor'easters)
- **Other inputs—not covered in this presentation**
  - Structure/damage element data for EVERY property in study area
    - Values
    - First floor elevations
    - Structure type
    - Coastal armor

SBEACH

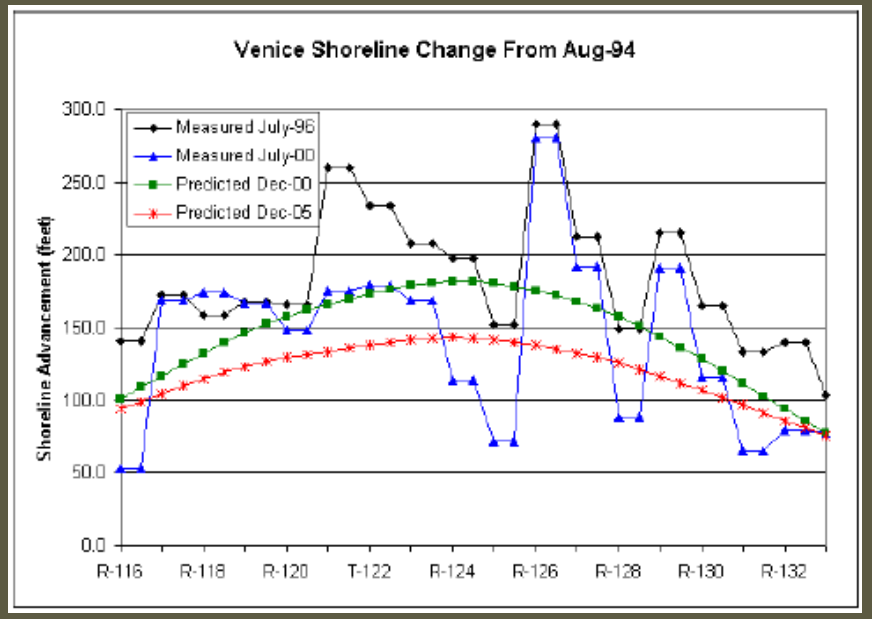
- **Input data**
  - waves, water level, winds
  - Beach profiles: pre- and post-storm for calibration
- **Output**
  - detailed waves, surge, and erosion for each historical storm
- **Simulation time scale: days-weeks**



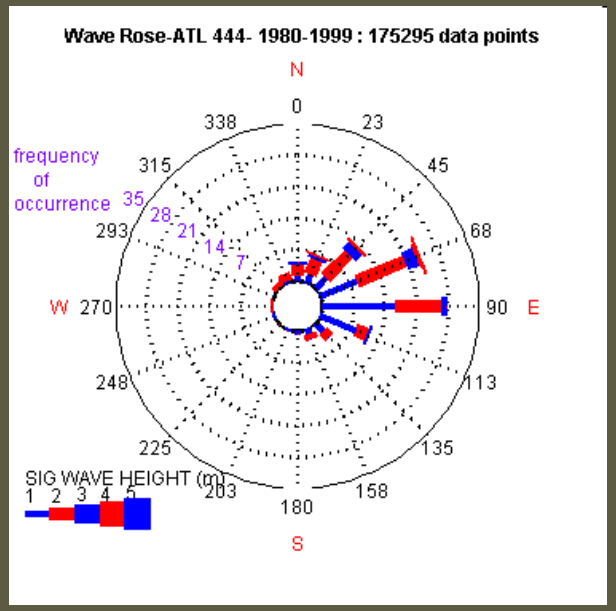


GENESIS

- **Shoreline position data**
  - Multiple years
  - Calibration/verification



- **Wave data**
  - Height
  - Period
  - Direction
  - Time scale: years-decades



Historical Storm Data

- **Site-specific storm database**
  - Time series for each storm
    - Waves
    - Water levels
    - Wind
  - Decades of storm seasons required

Beach-fx Data Sources

- **Profile data, shoreline data**
  - Periodic surveys
    - FDEP, Sponsors
  - LIDAR

- **Wave Data: Long-Term**
  - Wave Information Studies (WIS) ERDC
    - 1980-1999
    - Needs updating/longer hindcast
  - Commercial Sources
    - Custom, site-specific wave hindcasts 50+ years

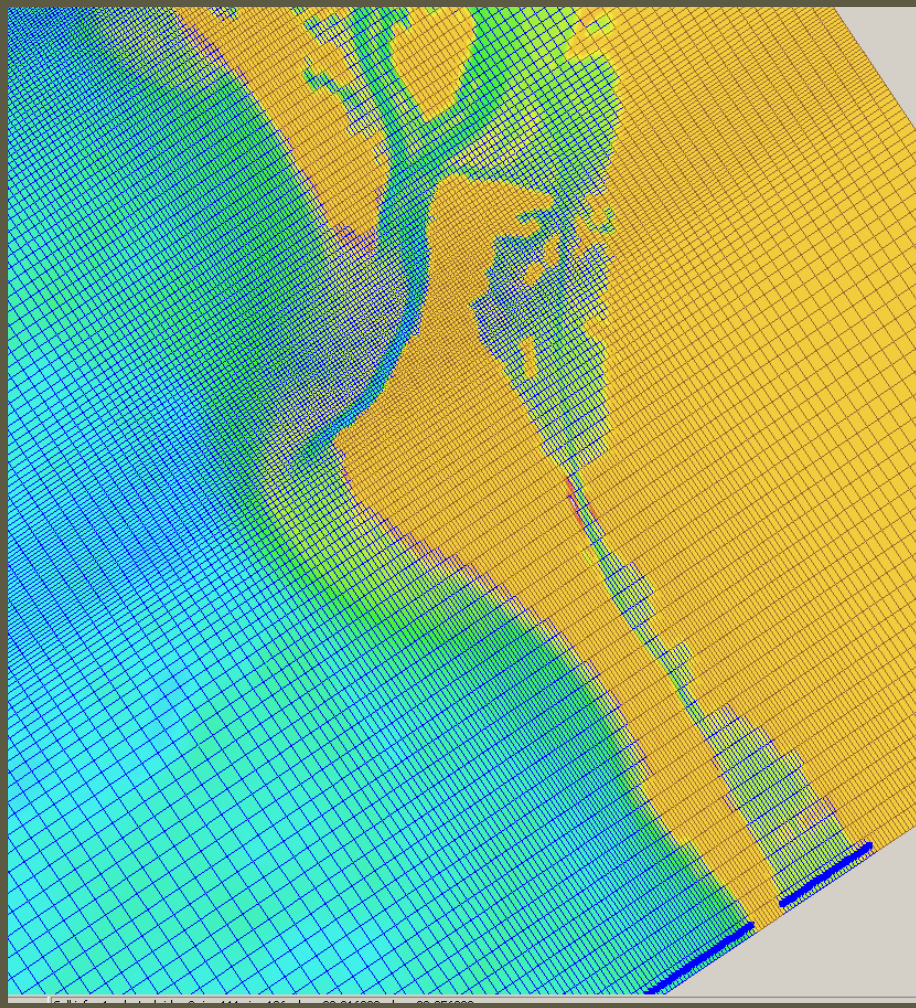
Beach-fx Data Sources

- **Short-Term (Storms)**
  - Wave and wind
    - Wave buoy data
      - NDBC (NOAA)
      - CDIP (Scripps)
    - Commercial sources: Oceanweather storm hindcasts

- **Storm Data: Long-Term**
  - Tropical: NOAA HURDAT 1851-2005
    - Developed in 1960's, updated periodically
    - Storm track, central pressure, winds
    - No water level or wave information
  - Extra-tropical storms
    - No central database
  - Site-specific historical storm database
    - Difficult to formulate
    - Time consuming/expensive

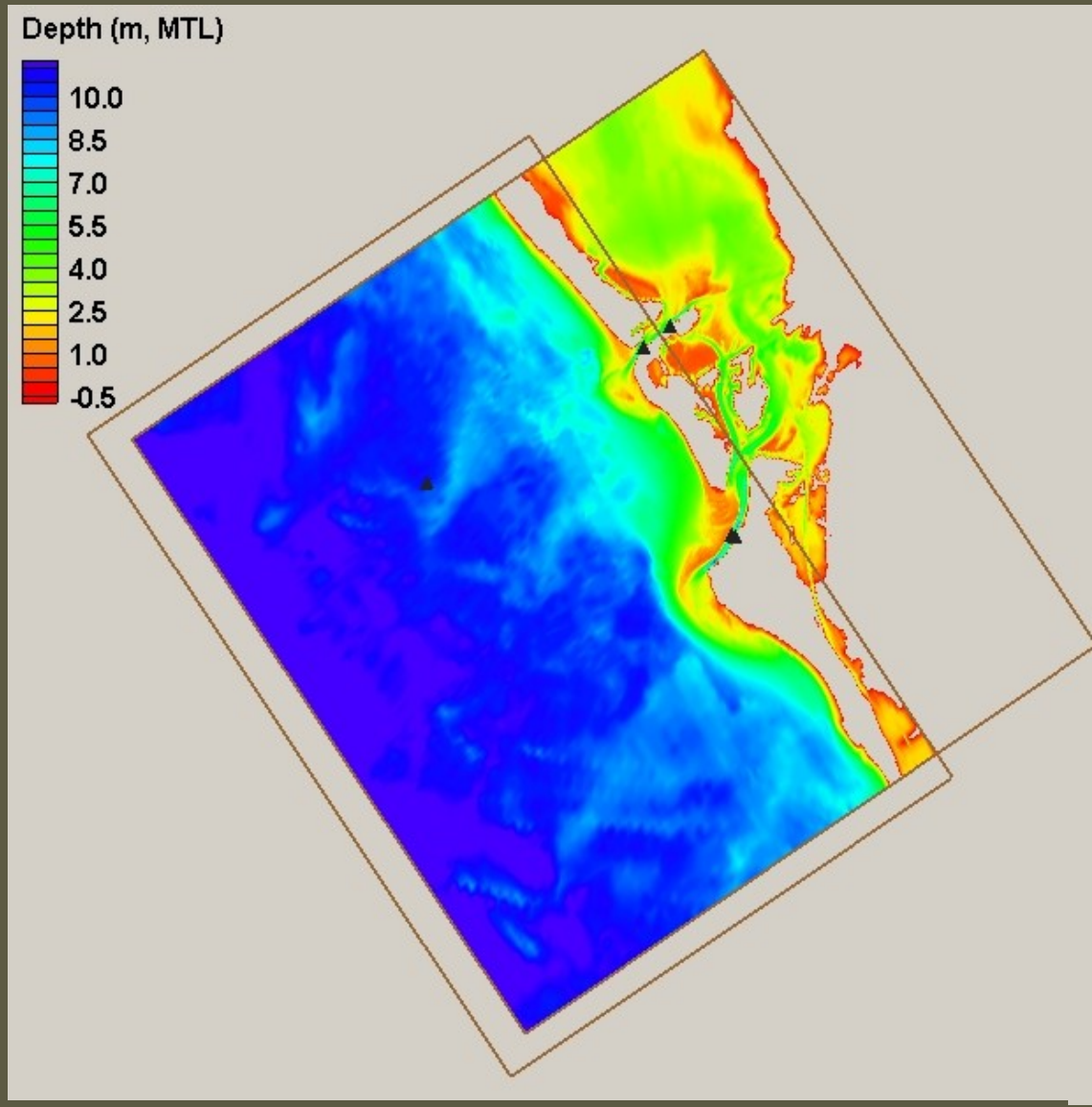
Inlet and Navigation Projects

- **Coastal Modeling System (CMS)**
  - 2D Hydrodynamic Circulation Model
  - Spectral wave transformation model
  - Hydrodynamic/Wave coupling: sediment transport capability
  - Evaluate existing morphology and alternatives
  - Regional spatial scale
- **Increased expectation to include comprehensive models at inlets and Navigation projects**
  - Powerful
  - Data hungry
  - Time consuming/expensive



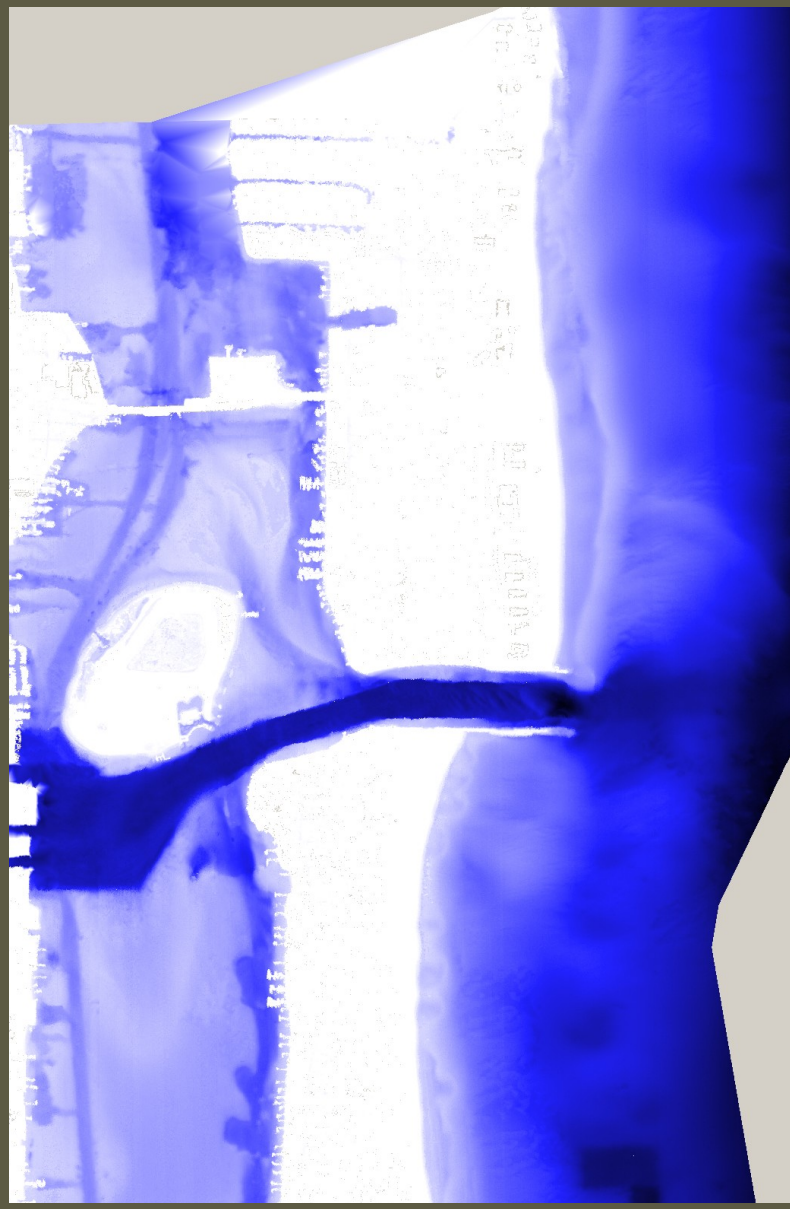
CMS Inputs

- **CMS Wave: Spectral wave transformation model**
  - Wave, wind boundary conditions
  - Gridded bathymetry
- **Hydrodynamic model**
  - Water level, water current boundary conditions
  - Gridded bathymetry
- **Sediment characteristics**



CMS Data Sources

- **High-resolution bathy data**
  - Multibeam
    - USACE survey vessels
    - Contractors
  - LIDAR: JALBTCX
- **Essential for Calibration/Verification**
  - Multiple surveys: morphology
  - Closely spaced in time

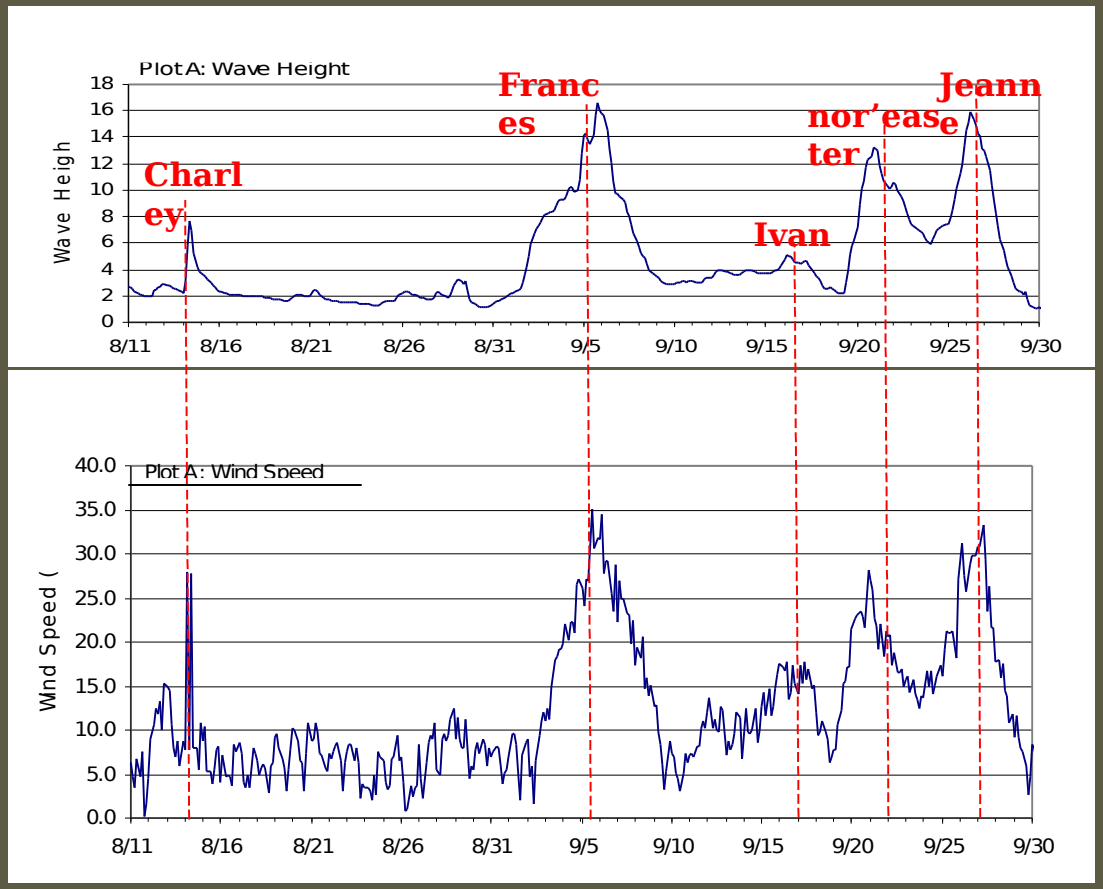


CMS Data Sources

- **Water level and directional wave data**
  - NOAA tide stations
    - Too few permanent gages
  - Permanent directional wave gages
    - NDBC, CDIP, IOOS
    - Too few, some too far from shore
- **Custom field data sets**
  - Contracted
  - 5 In-situ gages
  - 3 Mobile current sites
  - $104k
  - Need ability to share/search data

Post-Storm Missions

- **Example: 2004 Hurricane Season**
  - 4 Land falling Hurricanes
  - Majority of Florida Beaches Sustained Significant Damage



Survey Data

Type of Survey Data

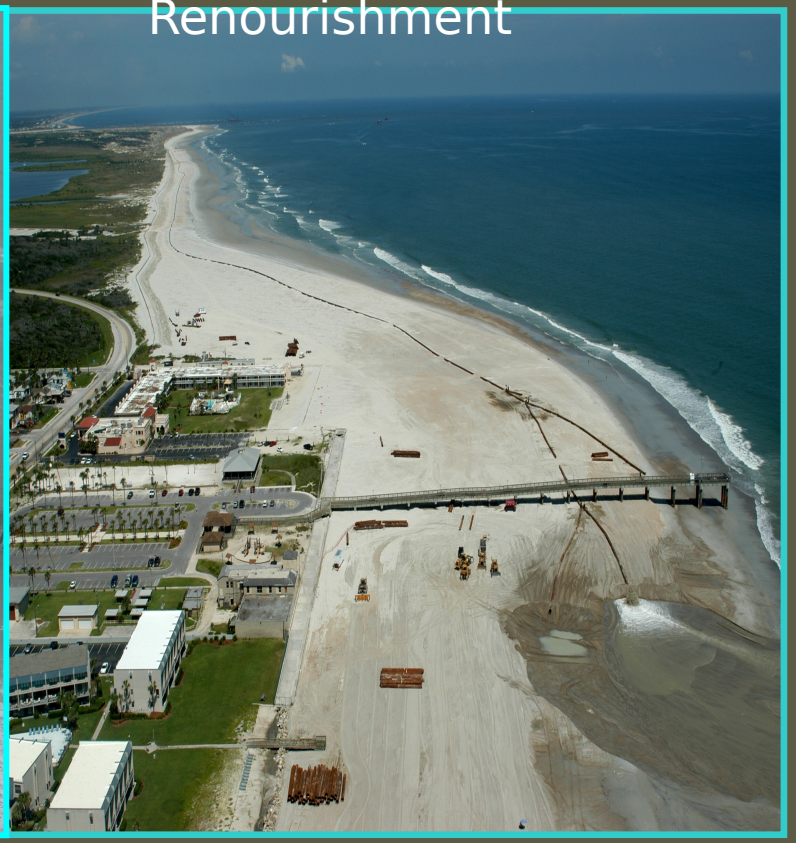
Provider	Pre-Storm	Post-Storm		P&S
Brevard Co. Sponsor	Profile		Profile	Profile
Broward Co. JALBTCX/Sponsor	LIDAR	LIDAR	Profile	
Duval Co. JALBTCX/Sponsor	Profile		Profile	Profile
Ft. Pierce JALBTCX/Sponsor	Profile		Profile	Profile
Lee Co. Sponsor	Profile		Profile	Profile
Manatee Co.	LIDAR	LIDAR	LIDAR	JALBTCX
Martin Co. JALBTCX/Sponsor	Profile		Profile	Profile
Palm Beach Co.	LIDAR	LIDAR	LIDAR	JALBTCX

2005 Beach Restorations

14 Federal Shore Protection Projects Renourished

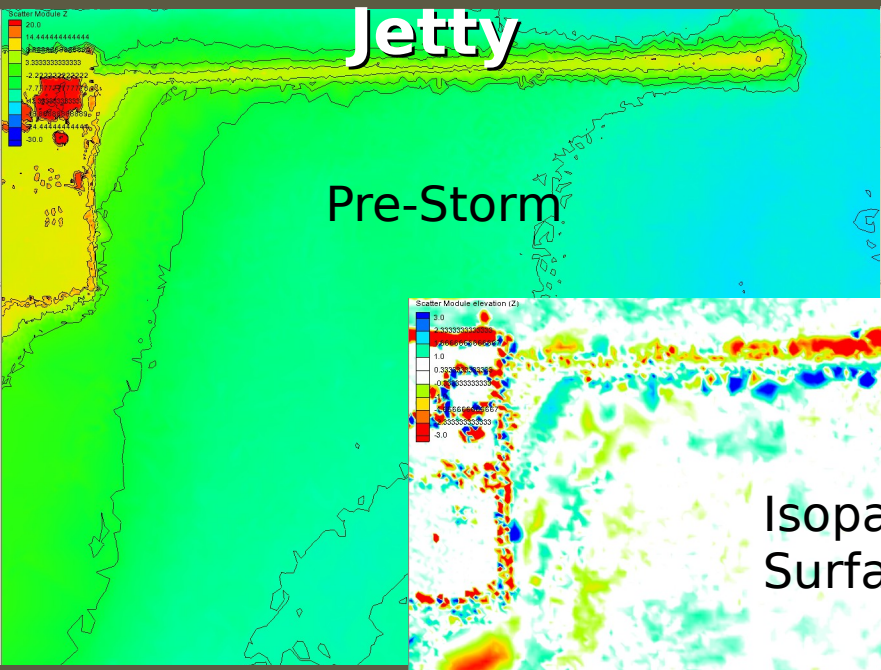
2004 Post-Storm(s)

2005 Renourishment

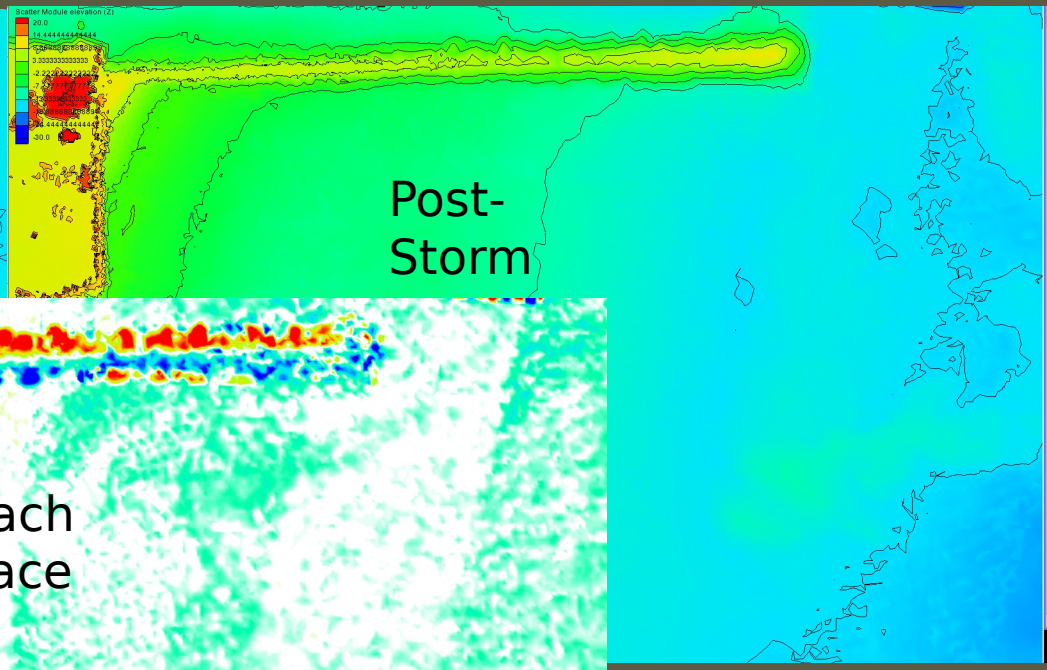


Post-Storm Inspections

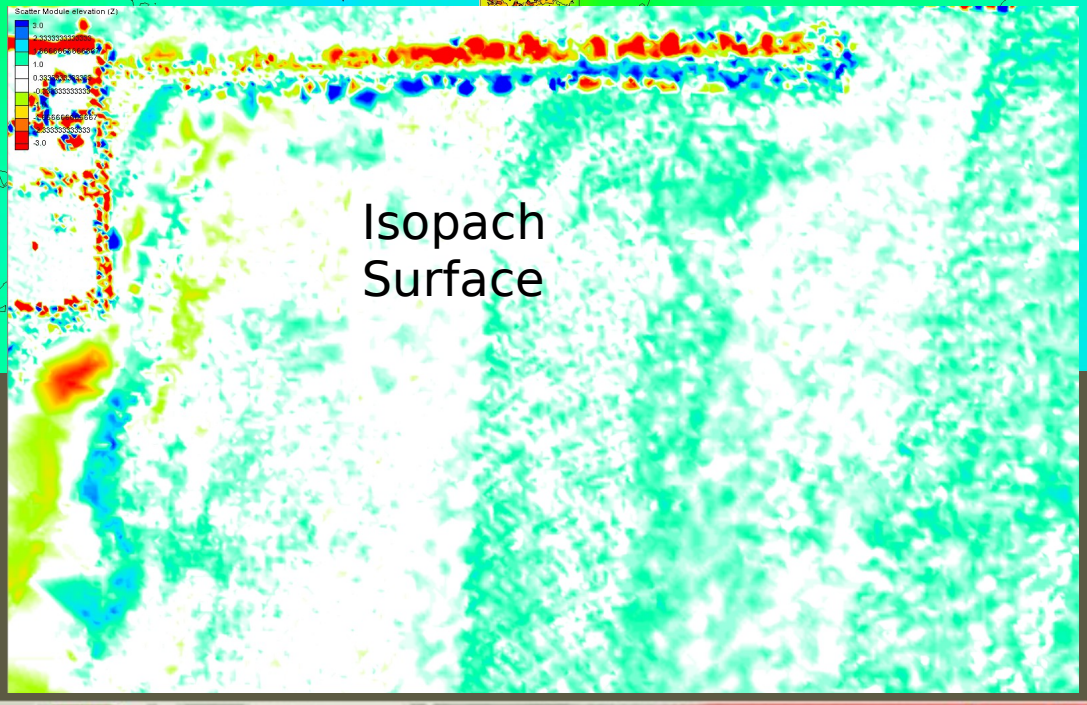
LIDAR Surveys Port Everglades South Jetty



Pre-Storm



Post-Storm



Isopach Surface

Post-Storm Data Sources

- **Pre- and post-storm season surveys are essential**
  - Post-storm data collected asap following storms
- **LIDAR data served a vital need**
- **Too few water level and wave gages**
  - Commercial hindcast data utilized for wave/wind information
  - Important storm surge information not collected

Conclusions

- **Coastal Storm Damage Reduction Projects**
  - Historical storm databases
    - Improved tropical/extra-tropical storm data
    - Tools for site-specific data extraction
- **Inlets and Navigation Projects**
  - Long-term wave and water level measurements
  - Improved field data reduction tools
    - Open-source code
- **Post-storm Missions**
  - Annual LIDAR surveys

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Thank You

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